Examining the Implementation of ISO 9001 in Indonesian Construction Companies

1. Introduction

Civil engineering projects in Indonesia has often been criticised by stakeholders as being of poor constructed quality (Media Online Finroll, 2009; Ombudsman-Asahan, 2008; Pontianak Post Online, 2006; Radar Banten, 2007). The results of a survey of quality in construction by the Federation Internationale des Ingenieurs-Conseils (FIDIC), has clearly indicated that the failure in construction quality is a problem worldwide (Rumane, 2011). Quality is considered as one of the key elements of methods and techniques of project management in construction work (Pamulu and Husni, 2005). In line with this, the Project Management Institute (PMI, 2008) describes 'project quality management' as the processes required to ensure that a project will satisfy the needs of the planning process (quality planning), executing process (quality assurance), and controlling process (quality control). Although current project management practices are the main determinants of the quality of construction outcomes, an additional major parameter relates to the constructors and builders' quality management systems (QMSs) (Asa *et al*., 2009). At present, the effective operation of QMSs-related quality problems and attendant quality processes, practices and procedures of Indonesian construction companies, are a critical concern to construction industry clients when seeking qualified professional building companies capable of meeting their requirements and providing project satisfaction (Pamulu and Husni, 2005; Susilawati *et al*., 2005).

Substandard quality is currently subject to serious scrutiny by both the Indonesian government and the construction industry (ICA, 2010; Secretariat of BPKSDM, 2009). The Indonesian Government has enacted specific regulations, namely Decree of Ministry of Settlement and Regional Infrastructure Number 339/KPTS/M/2003, requiring G-7 construction companies[1] to develop and implement QMSs, based on the ISO 9001 standard.

For most clients, QMS implementation of ISO 9001 certified construction companies needs to be evidenced in high levels of quality in construction work. The work should fully satisfy both the requirements and expectations of clients. However, in reality there are often complaints from project owners and end-users, relating to the poor performance of construction companies. The number of such complaints is steadily increasing. Indonesian newspapers often highlight the complaints coming from local government officials. Among

[1] G7 - the highest grade of Indonesian contractor qualification; necessary in order to be eligible to tender for government projects having a value of 100,000 USD up to an unlimited project value.

others, there were five government projects totalling 9.15 billion rupiah (915,000 USD) in value in the Asahan Tanjung Balai district in North Sumatera province, which did not meet project specifications (Ombudsman-Asahan, 2008). Several other projects with a total cost above 1 billion rupiah (100,000 USD) in the districts of Melawi and Pontianak in West Kalimantan province and in Merak-Banten province, were improperly implemented (Pontianak Post Online, 2006; Radar Banten, 2007). The South Sulawesi Provincial Government has also issued complaints of non-compliance to schedule requirements to a construction company undertaking a fly-over project in Makassar. The delay in completing that project lead to a serious impact on traffic congestion (Media Online Finroll, 2009). There appears to be a substantial gap between the established and inherent goals of ISO 9001 and the management practices of many certified companies, in relation to sizeable construction and infrastructure projects in Indonesia.

Other researchers have found that construction industry has generally been slow to adopt and implement effective quality systems (Leonard, 2010; Oztas *et al*., 2007). There remains much to be done to fully exploit the potential benefits from QMS implementation and thereby achieve quality improvement in the construction industry outputs (Ahmed *et al*., 2005; Hoonakker *et al*., 2010; McCabe and Boyd, 2004). The successful implementation of QMSs requires a total change in organisational focus. It may require an adoption of a new culture that focuses on achieving greater customer satisfaction and improving in operational processes at all levels within construction companies (Willar *et al*., 2010).

Despite the above reported findings, only limited research have been conducted to date into the application of QMSs in the Indonesian construction industry. Therefore, this paper examines the implementation of QMSs within construction companies in Indonesia. This study was particularly focused on: (a) motives for applying ISO 9001 certification; (b) the extent of QMS practices; (c) barriers to implementing QMSs; and (d) evaluation of subsequent performance of companies when implementing their QMSs in accordance with the ISO 9001 standards. The findings of the survey are discussed and recommendations are presented in relation to how larger-scale Indonesian construction companies can further improve their current QMS practices and thereby improve their performance. These results are of potential use in attempts to introduce the benefits of implementing ISO 9001-based QMSs to other Indonesian construction companies, especially to the small-medium contractors and builders.

The study was limited to G-7 contractors since only these contractors are required to hold ISO 9001 certification, while grade 6 contractors and others within small and medium

scale categories are not currently required[2]. A revision of the regulations is a necessity in order to guide the reform process in the Indonesian construction industry, particularly in relation to the terms of quality systems and quality products. The research findings from this study can potentially positively contribute to achieving this objective.

2. Quality management systems in construction

The construction industry is more complex and uncertain than the manufacturing industry (Ibrahim *et al*., 2010). Different projects or construction firms exhibit unique characteristics, coupled with the changing demands of the industry's stakeholders, combining different investors, clients, contractual arrangements and consulting professions (cidb, 2012; Oyewobi *et al*., 2013). Quality management in the construction industry is different from that in the manufacturing or other service industries. This is because the construction industry encompasses not only the quality of products, but also the total management approach needed to meet defined clients' requirements (Rumane, 2011). Lam *et al*. (1994, p. 15), in respect to the construction industry, defined 'quality management' as "that aspect of the overall management function that determines and implements the quality policy", and 'quality system' as "the organisational structure, responsibilities, procedures, processes and resources for implementing quality management". Hoyle (1997) indicated that the production of desirable quality products does not happen by chance, rather it must rely on using a quality system as part of a management suite to meet all of the established quality goals. Thorpe and Sumner (2004, p. 3) support that achieving quality is significant for business performance. They describe a quality management system in companies as "a formal statement of an organisation's business policy, management responsibilities, processes and their controls, that reflects the most effective and efficient ways to meet (or exceed) the expectations of those it serves, while achieving its own prime business objectives". These same authors recommend that organisations establish a QMS for the fulfillment of customers' needs and satisfaction.

The QMS that has been most widely adopted by construction companies is the ISO 9000 series (Chini and Valdez, 2003; Farooqui and Ahmed, 2009; Low and Teo, 2004; Turk, 2006). This standard is actually a generic one that can be used successfully by construction companies in their projects. There are other quality systems, standards and awards, such as Six Sigma, the EFQM Excellence Model, Malcolm Baldrige National Quality Award

[2] The Indonesian construction companies' grading system [I], which consists of grade 4 companies (small scale category) that mostly act as sub-contractors and are eligible to take part in government projects valued at up to 100,000 USD; this value increases to 1 million USD for grade 5 companies (medium scale category). Grade 6 representing large scale contractors sometimes act as sub-contractors and are eligible to undertake government projects up to 2.5 million USD in value.

Criteria. However, ISO 9001 is widely accepted in many manufacturing, production and services industries. This because it specifically focuses on what organisations should do to achieve better quality management and continuous improvement. The ISO 9001 standard has been adopted by Indonesian construction companies. It has also officially been recommended by the Ministry of Settlement and Regional Infrastructure through Regulation Number 362/KPTS/M/2004, as an approach for resolving quality problems in the construction industry and for meeting customers' needs.

Successful implementation of a QMS requires *effective* planning, operations and review, as well as continuous improvement of the system at all levels of an organisation. *Effectiveness* has been defined as 'the extent to which planned activities are realized and planned results are achieved' (BSI, 2009). The term 'effectiveness' is particularly pertinent to quality management system implementation. To successfully implement their QMS, companies must meet their specified quality requirements and prescribed quality objectives without any shortfalls. However, many people mistakenly think that effectiveness comes from only meeting the specified requirements and the prescribed quality objectives (Al-Nakeeb *et al*., 1998). In fact, it refers to the effectiveness of the system in meeting and complying with the specified requirements of the adopted standard. This means that *effectiveness* in the overall sense should really mean two objectives: (i) the *full* meeting of a company's own specified quality requirements; and (ii) the *full* meeting of the prescribed quality objectives contained in the eight quality management principles enshrined in the standard. It should also mean the implementation of a system that complies with the requirements of the ISO 9001 standard. This view is represented in Figure 1.

[INSERT FIGURE 1 HERE]

3. Research methodology

A quantitative research approach was employed to collect the relevant information associated with the quality management systems (QMSs) practices within G-7 Indonesian construction companies. To ensure that meaningful data was collected, the questionnaire was carefully developed and tested in the pilot study. It was then followed by minor revisions in order to provide a well-validated survey instrument. The questions were primarily based on information derived from the literature review and preliminary studies. For example, a list of the most common problems related to the rolling out of QMSs in the construction industry was sourced from some of the common problems found in the literature. They were

confirmed in interviews with representatives of several construction companies in Manado and Jakarta, during the pilot study.

The questionnaire was delivered to 118 G-7 construction companies, which are ISO 9001 certified. Thirteen (13) of them were located in Manado, 25 in Makassar, and 80 in Jakarta. Those companies mainly engage in building and/or civil engineering works, including roads and bridges, highways and irrigation systems. Nine hundred questionnaire booklets were distributed to Quality Management Representatives (QMRs), Managers (e.g. Project Managers, Purchasing Managers, Logistic Managers, Maintenance Managers, Finance Managers), and Project/Site Engineers of those companies. These groups of respondents represented the high, middle, and lower management levels in the companies' organisational structure. They were considered appropriate representation to provide balanced data in terms of QMS implementation within the construction sector.

Seventy-seven companies returned the questionnaires, giving a response rate of 65.25%. The number of useable questionnaires returned was 403, coming from 67 QMRs, 215 Managers, and 121 Project/Site Engineers. Table I summarises the information relating to the returned questionnaires from surveyed companies and individuals. The data obtained from the surveys were analysed using SPSS Version 18.

[INSERT TABLE I HERE]

4. Research findings

4.1 Motives for developing quality management systems

The respondents were given a list of eight motives for seeking ISO 9001 certification derived from the literature review. They were asked to rank them from 1 (most) to 8 (least) in terms of how close these motives reflected their companies' circumstances. Of the 403 responses, 63 were excluded due to missing data. The final sample size for this section was therefore 340.

Table II summarises the survey results relating to the motivation of companies in seeking ISO 9001 certification. They were classified into three categories, rankings based on the company's perceived 'importance' of such certification. The highest ranked motive was '*to effectively and efficiently control project activities*'; the second ranking was '*for the betterment of the company's overall management system, to fulfil clients' requests as part of the bidding process, to improve business performance* and *to minimise poor quality of construction processes and products*'. The third ranking was '*as a requirement from the*

Ministry of Public Works, to improve the company's prestige (e.g. image, reputation) and *to enter the international construction market*'.

[INSERT TABLE II HERE]

The results of the survey show that the companies' motives in developing and implementing QMS are primarily to successfully operate projects without substantive time-delays and cost overruns. This scenario is common for construction organisations that are in the early stages of operating with QMS-ISO 9001. The survey results also revealed that, as also verified in other studies, the main initial motivation for ISO 9001 certification was to have an effective toolkit for improving quality management procedures in companies (Chini and Valdez, 2003; Turk, 2006). Some authors have opined that ISO 9001 certification is being pursued both for company marketing reasons and based on customers' requests (Chini and Valdez, 2003; Turk, 2006). The results of this study indicate similar motivations for Indonesian construction companies. However, there is no specific reference to establishing a foothold in international construction markets (see Table II).

4.2 Levels of quality management system implementation

Table III shows the responses from the respondents regarding the level of implementation of each major *principle* (i.e. $X^{th}P$) of the ISO 9001 standard in their companies. The analysis was based on the respondents rating of each item in the questionnaire related to the current level of ISO 9001 *principles* implementation, with '1' = 'yet to be implemented', '2'= 'minimally implemented', '3' = 'not so fully implemented' and '4' = 'fully implemented'.

[INSERT TABLE III HERE]

Table III shows that all of the eight major ISO 9001 principles were rated at level '3', which represents a state of being 'not so fully implemented'. This is borne out by the mean scores that ranged from 2.51 to 3.50. The standard deviations (SDs) were relatively small, indicating that the data points were close to the mean (Field, 2009). These results also indicate that the mean is an appropriate statistical metric for summarising the current implementation level of ISO 9001 principles. The 95% confidence interval (CI) for the mean was calculated to examine the 'cut-off point' for the determination of the four levels of the ISO 9001 principles implementation.

An ANOVA test was used to assess differences in implementing the ISO 9001 principles between the three levels of respondents (see Table IV). There are no significant differences between the three levels of respondents relating to the implementation of ISO 9001 principles, except for the first principle (1^{st}P). The middle level respondents are more likely to put an emphasis on the implementation of customer focus principle (1^{st}P) than the other two levels of respondents.

[INSERT TABLE IV HERE]

Table V presents the responses from the respondents regarding the levels of implementation of each element of the ISO 9001 standard, in their own companies. The survey findings indicate that, 19 elements were at level '3' of implementation ('not so fully implemented'), with mean scores ranging from 2.84 to 3.47. One element (statistical techniques) was at level '2' (mean = 2.38), indicating that the element was only minimally implemented.

[INSERT TABLE V HERE]

An ANOVA test was also used to assess the differences in implementing the ISO 9001 elements between the three levels of respondents (see Table VI). The result shows that there are significant differences among the three levels of respondents in evaluating the implementation of the 5^{th}, 7^{th} and 14^{th} elements of ISO 9001. The higher management level of respondents identified the *implementation of document and data control* (5^{th} element) as being more important than the other two levels. This element is particularly emphasized by Quality Management Representatives (QMRs). QMRs are responsible to assure that all documents, related to the quality of products and services, are used and controlled properly to meet the conformance status of this element. The middle level (Managers) of respondents appear more likely to pay attention to the implementation of *control of customer-supplied product* (7^{th} element), and *corrective and preventive action* (14^{th} element). These two areas where managers are more able to ensure their customers obtain satisfaction from product/service delivery.

[INSERT TABLE VI HERE]

The results of this study show that additional effort is still needed to achieve full implementation of QMS-ISO 9001 systems, to gain the potential benefits from holding their certification. The seventh principle and the 20th element are the two attributes of the standard identified as being least implemented among the Indonesian contractors. This is significant, since other studies have reported that effective decision making is based mainly on using data analysis and information (Tricker, 2008), with the assistance of some statistical tools.

Full implementation of QMS-ISO 9001 system requires companies' internal stakeholders to apply quality standards to the whole business process of their organisation (Trigunarsyah *et al*., 2011). As previously described, the construction industry's efforts to improve quality have been slow and fragmented (Leonard, 2010). It is also being fraught with difficulties in implementing ISO 9001 and instilling a holistic and systematic Total Quality Management philosophy (Haupt and Whiteman, 2004; Hoonakker *et al*., 2010; Shibani *et al*., 2010). This is due to the characteristics of the construction industry and its project processes.

4.3 Problems affecting quality management system implementation

Another part of the QMS questionnaire survey was designed to evaluate the barriers encountered by companies during the implementation of an effective ISO 9001 system. The respondents were asked to identify problems in relation to QMS implementation, based on their experiences, with '4' = 'often experienced', '3' = 'sometimes experienced', '2' = 'very seldom experienced' and '1' = 'not experienced'.

[INSERT TABLE VII HERE]

The results summarised in Table VII show that the Levels of Barriers (LoB) fall mainly into two categories, level '3' ('sometimes experienced') ranked from 1 to 7, and level '2' ('very seldom experienced') ranked from 8 to 14. The mean rating of the barriers shows that although respondents do not often experience problems related to QMS implementation, most frequently cited barriers that may affect effective QMS implementation were: (i) '*ISO 9001 is a matter of fulfilling audit requirement*' (B7); (ii) '*misleading QMS purposes*' (B1); and (iii) '*lack of a well-design reward system*' (B9).

The results of this study show that there are some misunderstandings by the managers surveyed regarding the purpose of obtaining the ISO 9001 certification. Many managers see this solely in terms of a marketing initiative, or a necessity due to customer pressure. They

also see the certification is a way to avoid receiving non-conformance reports (NCRs) during audits. Such misconceptions have clearly inhibited any internal improvements to a company's effectiveness in implementing its QMS. This raises a question of 'how does the construction industry overcome the problems related to quality?' Focusing construction companies' efforts on effective practices and continuous improvement of their QMSs can result in developing the capability in the delivery of high quality projects.

Current ongoing research in the area of construction management has revealed strong evidence that organisational issues, such as developing a quality culture and a strong corporate culture, are determinant factors in contributing to the successful implementation and maintenance of an effective ISO 9001 quality system (Koh and Low, 2008; Marrewijk, 2007; Yip and Poon, 2009). By examining and integrating definitions from a number of sources, Coffey (2005, p. 94) adopts the following hybrid definition of organisational culture: *".....the informal shared values, norms and beliefs that control how individuals and groups in organisations consistently perform tasks, solve problems, resolve conflicts and interact with each other and with others outside the organisation."* However, for this to occur, all of the organisational practices which are ingrained in a company's organisational structure, processes, methods and procedures, must be constantly reformed and managed in order to produce a fully effective organisation (Nadler and Tushman, 1980). In addition, companies must all be in a state of congruence for good quality practices to operate (Koh and Low, 2008). This implies, for example, that if management applies a new approach that focuses on internalizing quality values (which are, by definition, part of an organisation's culture) among all organisational members (Bright and Cooper, 1993), then under these circumstances, organisational culture supports quality improvement.

There are some management traits that appear to act specifically as links between culture and QMS implementation in construction organisations. These include process management, leadership and management commitment, staff empowerment and effective communications. These traits have been identified as those likely to be most influential in determining the effectiveness of QMS implementation. The literature also reveals that a more thorough identification and application of those organisational practices and management traits can benefit QMS implementation, if merged with the eight ISO 9001 principles. For example, the role of manager/leader as motivator, facilitator, and driver for directing a construction company towards becoming an effective organisation (Mahmood *et al*., 2006; Muller and Turner, 2007; Ozorovskaja *et al*., 2007; Toor and Ofori, 2008). Some authors state that, by identifying staff competencies (ISO 9001:2008 clause 6.2.2), management can

properly empower staff to undertake the processes and operations that directly demonstrate the capability of a company's QMS (Mahmood *et al*., 2006; Zhang *et al*., 2000). Indeed, there is a need for changing the culture in the construction industry to enhance the adoption of 'good' attitudes and behavior in all parts of the organisation, and to understand the need to operate and espouse the values of the ISO 9001 standard - if companies fully understand the standard, they will be able to apply it properly.

4.4 Key performance indicators of ISO 9001 certified contractors

In order to examine the performance of Indonesian G-7 contractors during QMS implementation, the respondents were asked to rate the level of their companies' current key performance indicators (KPIs) with '4' = 'very high performance'; '3' = 'high performance'; '2' = 'low performance', '1' = 'very low performance'. Table VIII presents the means, standard deviations and performance levels of each KPI.

[INSERT TABLE VIII HERE]

The results show that the means of all eight KPIs are less than 3.00, ranging from 1.40 to 2.95. This indicates that there are three levels of KPI (LoKPI). '*Global market contracts acquired*' (mean = 1.40) is considered to currently exhibit the worst performance of KPI (LoKPI = 1). The next lowest level of performance of KPI (LoKPI = 2) was identified as being '*new product innovation and development*' (2.43). However, all companies achieved a relatively high performance level of KPI (LoKPI = 3) in terms of '*quality of services and products*' (2.95), '*sales growth*' (2.87), '*profitability*' (2.83), '*sustainable construction products*' (2.75), '*market share*' (2.72) and '*generating employee satisfaction*' (2.69).

Studies of the effects of QMS implementation in the construction industry show that not only do customers benefit substantially from it (Liu, 2003), but also the construction companies (Hoonakker *et al*., 2010). An overview of the current performance of surveyed companies suggests that the Indonesian G-7 contractor's achievements in several key performance areas have not yet achieved a very high performance level. This could be due to the QMSs implementation issues suggested in the results of this survey, particularly for companies which have not tried to attain ISO 9001 certification to be able to compete in the international construction market.

5. Conclusions

A general overview of the existing QMSs currently being operated by large-size Indonesian construction companies (G-7) was obtained through the conduct of a questionnaire survey. The results revealed that the initial motivation for obtaining ISO 9001 certification by most of the G-7 contractors surveyed was focused on more effective management and efficient control of project activities. This implies that Indonesian G-7 contractors have positive intentions in improving their quality performance, to achieve the potential benefits from proper quality system implementation. Regarding potential difficulties that construction companies may experience in the process of attaining their QMS, the issues of management attitude and purposes were identified as most common barriers to G-7 contractors effectively implementing and continually improving their existing QMSs. For QMS implementation and an approach such as ISO 9001 to provide effective solutions to the problems within, and achieve high quality standards within the construction industry, all levels of a company's structure need to be bound by a strong commitment, effective development of internal and external communications with people involvement and participation. Combined, this is regarded as capable of developing organisational cultures that can, in time, overcome current barriers to ineffective QMS implementation. The methods and strategies for implementing QMSs may vary substantially between companies. In addition, the commitment of internal organisational stakeholders is also essential.

It is concluded that all Indonesian contractors and builders need to strive to attain improved company performance in order for such companies to increase their opportunities for eventually entering global construction markets. The expressed objective of both the Indonesian Government and customers for the greater implementation of robust QMSs in the construction industry urgently needs to occur, so that there is a link between QMSs and company practices (currently this is only evident for G-7 construction companies). Once achieved in large companies, it can also be espoused and integrated into the small and medium size companies that actually undertake much of the work directly related to quality outputs in projects.

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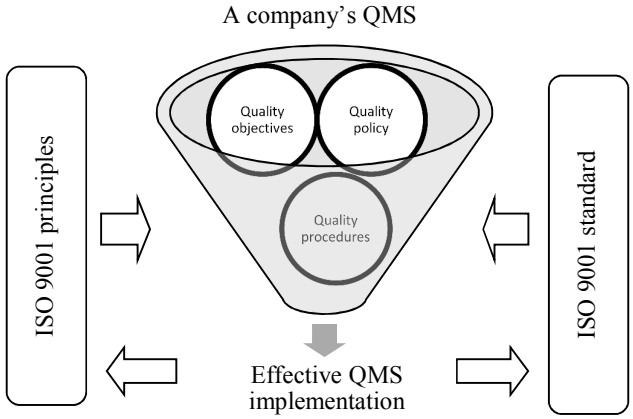

Figure 1 - Effective QMS implementation compliance with ISO 9001 standard and principles

Table I - Returned questionnaires from companies and individuals

City	Companies that returned questionnaires (n=77)	High level-QMRs (n=67)	Middle level-Managers (n=215)	Low level-Project/Site Engineers (n=121)
Manado	13	11	56	33
Makassar	23	22	66	42
Jakarta	41	34	93	46

Table II - Initial motivation of companies to apply for ISO 9001 certification (N=340)

Rank	Motives driven the devlopment of company's QMS under ISO 9001	Mode	Median	Mean	SD
1st	To effectively and efficiently control project activities	1	2	3.29	2.21
2nd	For the betterment of the company's overall management system	3	4	3.84	1.92
2nd	To fulfil clients' requests as part of the bidding process	2	4	4.20	2.34
2nd	To improve business performance	4	4	4.33	2.26
2nd	To minimise poor quality of construction processes and products	3	4	4.36	1.95
3rd	As a requirement from the Ministry of Public Works	8	5	4.91	2.47
3rd	To improve the company's prestige (e.g. image, reputation)	8	6	5.48	2.11
3rd	To enter the international construction market	8	6	5.61	1.99

Note: 1st = first ranked motive (most important), 2nd = second ranked motive, 3rd = third ranked motive

Table III - Implementation levels of ISO 9001 principles (N=403)

Rank	QMS-ISO 9001 Principles	Mean	SD	95% CI	LoI
1	Customer focus (1st P)	3.41	.62	3.35 - 3.47	3
2	Mutually beneficial supplier relationships (8th P)	3.31	.67	3.24 - 3.38	3
3	Leadership (2nd P)	3.21	.73	3.14 - 3.28	3
4	Systems approach (5th P)	3.19	.74	3.12 - 3.26	3
5	Continual improvement (6th P)	3.19	.81	3.11 - 3.27	3
6	Process approach (4th P)	3.15	.75	3.08 - 3.23	3
7	People involvement (3rd P)	3.09	.74	3.02 - 3.16	3
8	Factual approach to decision making (7th P)	3.06	.80	2.98 - 3.14	3
	Total QMS-ISO 9001 Principles	3.20	.48	3.16 - 3.25	3

Notes: Level of Implementation (LoI): 4 = fully implemented (mean = 3.51 - 4.00), 3 = not so fully implemented (2.51 - 3.50), 2 = minimally implemented (1.51 - 2.50), 1 = yet to be implemented (<1.50)

Table IV - ANOVA results: Significant group response

Item	Group	Mean	F	Sig.
First QMS principle (1st P)	High Level	3.24	3.61	.028
	Middle Level	3.47		
	Low Level	3.41		

Notes: Sig.: $p < .05$

Table V - Implementation levels of ISO 9001 elements (N=403)

Rank	QMS-ISO 9001 Elements	Mean	SD	95% CI	LoI
1	Control of a nonconforming product (13th E)	3.47	.69	3.40-3.53	3
2	Process control (9th E)	3.43	.66	3.36-3.49	3
3	Contract review (3rd E)	3.40	.68	3.34-3.47	3
4	Control of quality records (16th E)	3.40	.70	3.33-3.47	3
5	Inspection, measuring and test equipment (11th E)	3.37	.77	3.29-3.44	3
6	Inspection and testing (10th E)	3.36	.68	3.29-3.43	3
7	Corrective and preventive action (14th E)	3.35	.68	3.28-3.41	3
8	Internal quality audits (17th E)	3.35	.75	3.28-3.42	3
9	Inspection and test status (12th E)	3.34	.71	3.27-3.41	3
10	Handling, storage, packaging, preservation, and delivery (15th E)	3.34	.71	3.27-3.41	3
11	Purchasing (6th E)	3.32	.69	3.25-3.38	3
12	Design control (4th E)	3.27	.69	3.20-3.33	3
13	Document and data control (5th E)	3.25	.75	3.17-3.32	3
14	Product identification and traceability (8th E)	3.20	.74	3.13-3.28	3
15	Servicing (19th E)	3.19	.79	3.12-3.27	3
16	Quality system (2nd E)	3.10	.65	3.04-3.16	3
17	Training (18th E)	3.09	.81	3.01-3.17	3
18	Management responsibility (1th E)	3.03	.76	2.95-3.10	3
19	Control of customer-supplied product (7th E)	2.84	.82	2.76-2.92	3
20	Statistical techniques (20th E)	2.38	.73	2.31-2.45	2
	Total QMS-ISO 9001 Elements	3.22	.46	3.18-3.27	3

Notes: Level of Implementation (LoI): 4 = fully implemented (mean = 3.51 - 4.00), 3 = not so fully implemented (2.51 - 3.50), 2 = minimally implemented (1.51 - 2.50), 1 = yet to be implemented (<1.50)

Table VI - ANOVA Results: Significant Group Response

Item	Group	Mean	F	Sig.
QMS element 5	High Level	3.51	6.54	.002
	Middle Level	3.25		
	Low Level	3.10		
QMS element 7	High Level	2.67	3.23	.041
	Middle Level	2.93		
	Low Level	2.77		
QMS element 14	High Level	3.31	3.63	.027
	Middle Level	3.43		
	Low Level	3.22		

Notes: Sig.: $p < .05$, $p < .01$

Table VII - Barriers to the effective quality management system practices (N=403)

Rank	Barriers	Mean	SD	95% CI	LoB
1	ISO 9001is a matter of fulfilling audit requirements (B7)	2.90	.92	2.81-2.99	3
2	Misleading QMS purposes (B1)	2.86	.94	2.77-2.96	3
3	Lack of a well-design reward system (B9)	2.83	.93	2.74-2.92	3
4	Failure in disseminating ISO 9001-QMS (B8)	2.67	.88	2.58-2.75	3
5	Lack of effective management response (B5)	2.66	.92	2.56-2.75	3
6	Lack of strong motivation (B4)	2.63	.97	2.53-2.72	3
7	Lack of funding for QMS implementation (B14)	2.53	.85	2.44-2.61	3
8	Uncertainty with sub-contractors and supplier quality systems (B12)	2.50	.90	2.41-2.59	2
9	Lack of effective internal communication (B10)	2.47	.92	2.38-2.56	2
10	Lack of corporate commitment (B3)	2.44	.98	2.34-2.53	2
11	Resistance to QMS implementation (B13)	2.41	.82	2.33-2.49	2
12	Difficulty in understanding ISO 9001 terminology (B6)	2.32	1.03	2.21-2.42	2
13	ISO 9001 is a documentation matter instead of opportunity to make a change (B2)	2.31	1.01	2.21-2.40	2
14	Poor external communication (B11)	1.91	.93	1.81-2.00	2
	Total Barriers	2.53	.61	2.47-2.59	3

Notes: Level of Barrier (LoB): 4 = often experienced (mean = 3.51 - 4.00), 3 = sometimes experienced (2.51 - 3.00), 2 = very seldom experienced (1.51 - 2.50), 1 = not experienced (<1.50)

Table VIII - Contractors' key performance indicators (N=403)

Rank	Key Performance Indicators (KPI)	Mean	SD	95% CI	LoKPI
1	Quality of services and products (KPI5)	2.95	.51	2.90-3.00	3
2	Sales growth for the preceding two years (KPI2)	2.87	.64	2.81-2.93	3
3	Profitability for the preceding two years (KPI1)	2.83	.62	2.77-2.89	3
4	Sustainable construction products (KPI6)	2.75	.63	2.69-2.81	3
5	Market shares for the most recent year (KPI3)	2.72	.64	2.66-2.78	3
6	Generating employee satisfaction (KPI8)	2.69	.68	2.63-2.76	3
7	New product innovation and development (KPI7)	2.43	.72	2.36-2.50	2
8	Global market contracts acquired (KPI4)	1.40	.51	1.35-1.45	1
	Total KPI	2.58	.37	2.55-2.62	3

Notes: Level of KPI (LoKPI): 4 = very high performance (mean = 3.51 - 4.00), 3 = high performance (2.51-3.00), 2 = low performance (1.51 - 2.50), 1 = very low performance (<1.50)